A Five-year Summary (1978-1982) of the Nestling Diet of Cassin's Auklets in British Columbia

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A FIVE-YEAR SUMMARY (1978-1982) OF THE NESTLING DIET OF CASSIN'S AUKLETS IN BRITISH COLUMBIA

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ABSTRACT

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Information on the nestling diet of Cassin's Auklets (Ptychoramphus aleuticus), collected on Triangle Island from 1978 through 1982, on Frederick Island in 1980 and 1981, and on Ramsay and Rankine islands in 1982, has been summarized. Nine prey categories were identified, of which calanoid copepods, euphausiids and fishes made up most of the meal biomass. The most important identified food species were Neocalanus cristatus, Thysanoessa spinifera, T. longipes and Euphausia pacifica. Fishes identified were Ammodytes hexapterus, Hemilepidotus sp., Sebastes sp., and Hexagrammos sp. Neither hyperiid amphipods, such as Parathemisto pacifica and Vibilia propingua, nor carideans, such as Pandalopsis dispar, Pandalus platyceros and Pasiphaea pacifica contstituted a major portion of Cassin's Auklet meals, although they frequently occurred in some years.

Key words: Cassin's Auklet, nestling diet, British Columbia

RÉSUMÉ

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On résume les données recueillies sur la régime allimentaire des oisillons de l'alque de Cassin (Ptychoramphys aleuticus) dans les îles Triangle (1978-1982), Frederick (1980-1981), Ramsay et Rankine (1982). Neuf categories de proies sont identifiées; les copépodes calancidés, les euphausiacés et les poissons constituaent presque toute la biomasse consommée. Parmi les proies, les espèces les plus importantes étaient Neocalanus cristatus, Thysanoessa spinifera, T. longipes et Euphausia pacifica. Pour ce qui est des poissons, Ammodytes hexapterus, Hemilepidotus sp., Sebastes sp. et Hexagrammos sp. étaient présents. Aucun amphipode hyperidé comme Parathemisto pacifica et Vibilia propingua ni caride comme Pandalopsis dispar, Pandalus platyceros et Pasiphaea pacifica ne constituaient une grande partie de la nourriture de l'alque de Cassin, mais ils étaient fréquemment présents certaines années.

Mots-clés: L'alque de Cassin, le regime alimentaire des oisillons, Colombie-Britannique.

INTRODUCTION

Cassin's Auklets (*Ptychoramphus aleuticus*, Fig. 1) are the most numerous nesting seabirds on Canada's west coast (Vermeer *et al.* 1983). Their total nesting population, which is found entirely in the northeastern Pacific Ocean, consists of as many as 900,000 breeding pairs, of which 62% utilize nesting islands on the British Columbia coast (Vermeer *et al.* 1979). As Cassin's Auklets constitute an important component of the seabird population and as there was little previous information on their nestling diet in British Columbia, I studied that subject from 1978 through 1982.

Cassin's Auklets bring zooplankton and fishes as food to their nestlings in a throat pouch. It is during the nestling period which generally occurs from the end of May to the end of July that prey can be adequately sampled, and changes in species and size with time determined. Aspects of the nestling diet of Cassin's Auklets on Triangle Island (50° 52'N; 125° 05'W) from 1978 through 1981 and on Frederick Island (53° 56'N, 133° 10'W) in 1980 and 1981 were previously reported by Vermeer (1981, 1985). Additional information on the nestling diet was obtained on Triangle, Ramsay (52°33'N; 131°22'W) and Rankine (52°15'N; 131°06'W) islands in 1982. The objectives here are to summarize the information on the nestling diet of Cassin's Auklets in British Columbia from 1978 through 1982, and to analyze the 1982 meal samples for hourly and seasonal variation in food composition. It is to be noted that the seasonal variation of the nestling diet from 1978 through 1981 has been discussed by Vermeer (1981, 1985).

METHODS

Food samples of Cassin's Auklets were collected, processed and identified as described by Vermeer (1981, 1985). Cassin's Auklet meals were collected on Triangle Island from about the end of May to the end of July in 1978 through 1981 and on Frederick Island during the same period in 1980 and 1981 (Table 1). In 1982, samples were collected on Triangle Island at 4 day intervals (Table 2) to determine if food varied in relation to the time the birds were captured. A limited number of samples were collected from auklets in 1982 on Ramsay and Rankine islands (Table 2), located in more shallow and sheltered waters than Triangle and Frederick islands for comparative purposes (Fig. 2). Differences between prey proportions were analyzed using 2x2 Contingency Tables.

RESULTS

A. Meals and meal sizes

The 998 Cassin's Auklet meals collected on the four islands from 1978 through 1982 weighed 19 kg (Tables 1 and 2). The average bird meal weighed 19 g. Individual values of weight varied from 17.6 to 21.2 g on Triangle Island from 1978 through 1982, and from 16.8 to 18.9 g on Frederick Island in 1980 and 1981 (Tables 3 and 4).

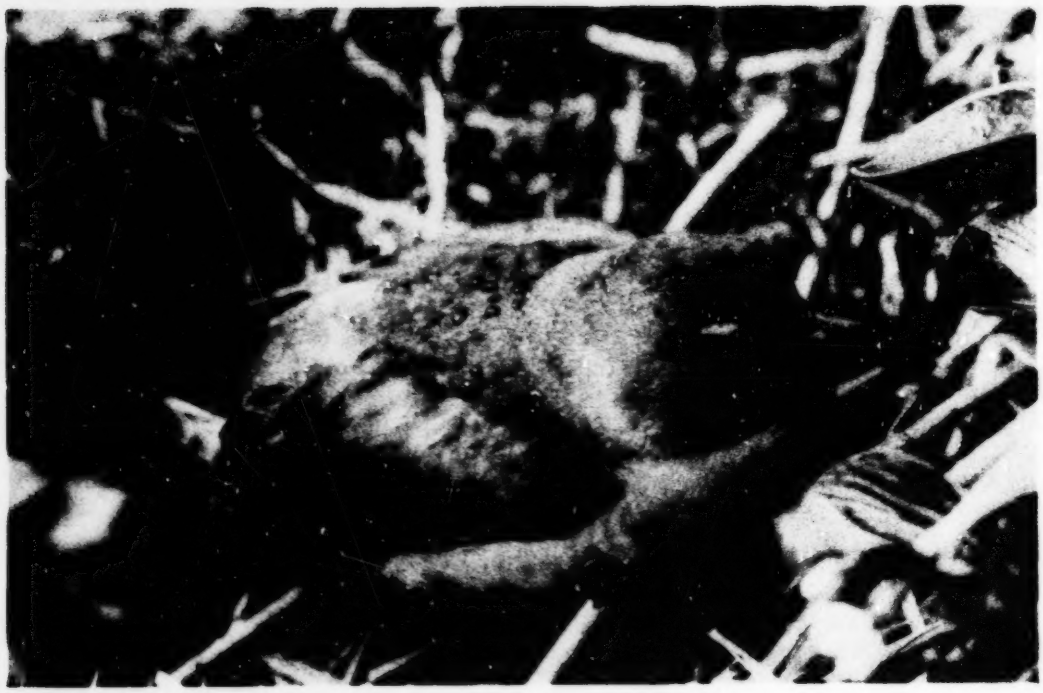

Figure 1. Adult Cassin's Auklet in nesting colony.

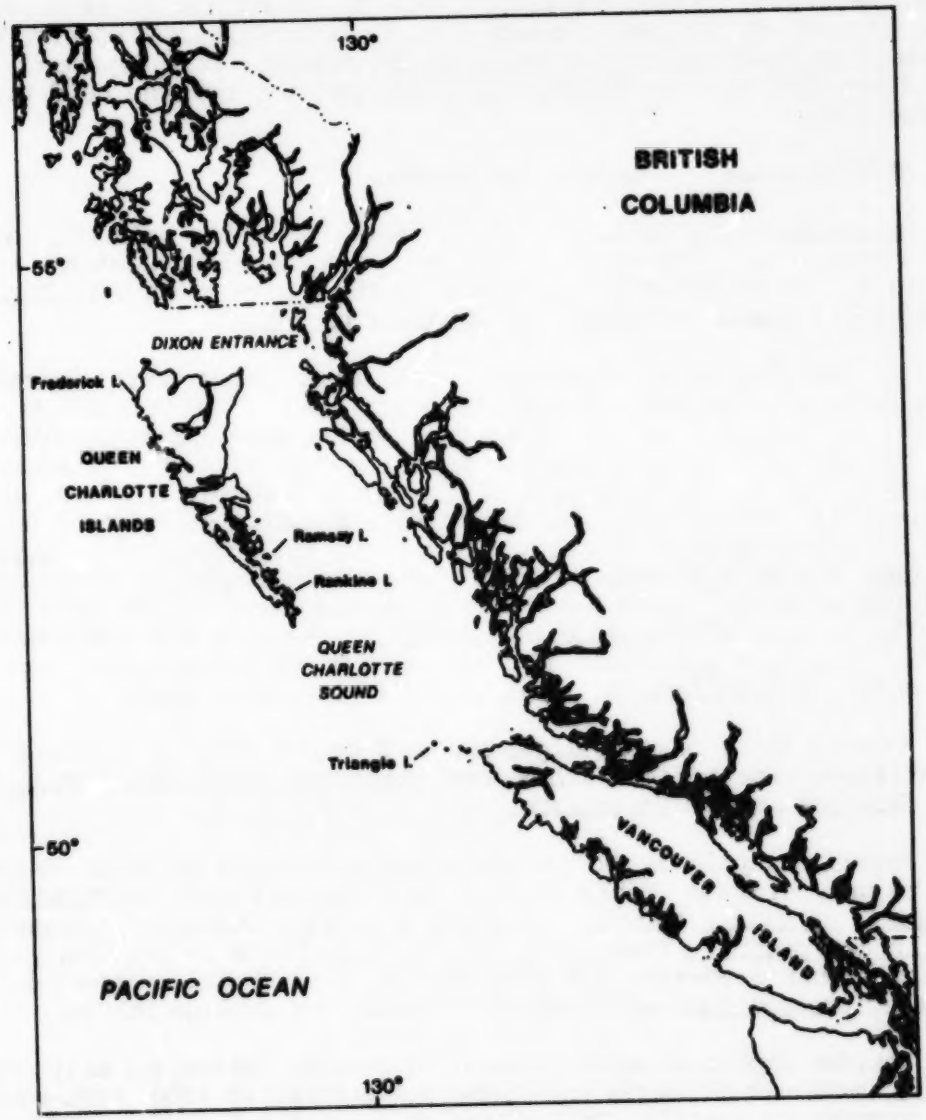

Figure 2. Location of nesting colonies of Cassin's Auklets where food samples were collected.

B. Food categories: occurrence and biomass

Nine food categories and unidentified digested matter were encountered in the nestling diet of Cassin's Auklets (Table 5). Calanoid copepods, euphausiids, fishes, carideans and hyperiid amphipods occurred most frequently in meal samples (Table 5). The first three categories made up most of the prey biomass (Fig. 3, Table 6). On Frederick Island, calanoid copepods and fishes were, on the average, more important in the nestling diet than on Triangle Island, but the reverse held true for euphausiids.

C. Prey species: occurrence and biomass

Neocalanus cristatus made up at least 99% of the calanoid copepods and was the most important food species of nestling Cassin's Auklets (Table 6). Other copepods encountered in the auklet meals were Neocalanus plumchrus, Calanus pacificus, and Metridia pacifica.

By far the most important euphausiid foods were Thysanoessa spinifera, T. longipes and Euphausia pacifica (Tables 7 and 8). Both adults and juveniles of the first two species were important food items for the auklets. Most Euphausia pacifica encountered were adults. T. spinifera was an important part of the birds' diet in all years, while T. longipes was identified as the principal euphausiid on Triangle Island in 1981 and 1982 and on Frederick Island in 1981 (Table 8). Euphausia pacifica was of some importance as a prey on Triangle Island in 1981 and 1982 (Table 8). Occasional euphausiid species found in the meal samples were T. raschii and Nematocelis difficilis. Many of the euphausids were partly digested and could not be identified to species, but were presumably T. spinifera, T. longipes and Euphausia pacifica.

Fishes were partly digested and could only occasionally be identified. Identified fishes were Ammodytes hexapterus, Hemilepidotus sp., Sebastes sp. and Hexagrammos sp.

Hyperiid amphipods and carideans did not constitute major components of the prey biomass (Table 6), but some species such as Parathemisto pacifica, Vibilia propingua, Pandalopsis dispar, Pandalus platyceros and Pasiaphaea pacifica frequently occurred as foods in certain years on Triangle and Frederick Islands (Table 9). Of these species, only Parathemisto pacifica was observed on Ramsay and Rankine islands.

Besides amphipods and carideans, brachyuran larvae commonly occurred in bird meals on Triangle and Frederick islands in 1980, 1981 and 1982. The gooseneck barnacle, Pollicipes polymerus as well as unidentified squid, octopus and scyphozoid medusae were occasional prey on Triangle and Frederick islands.

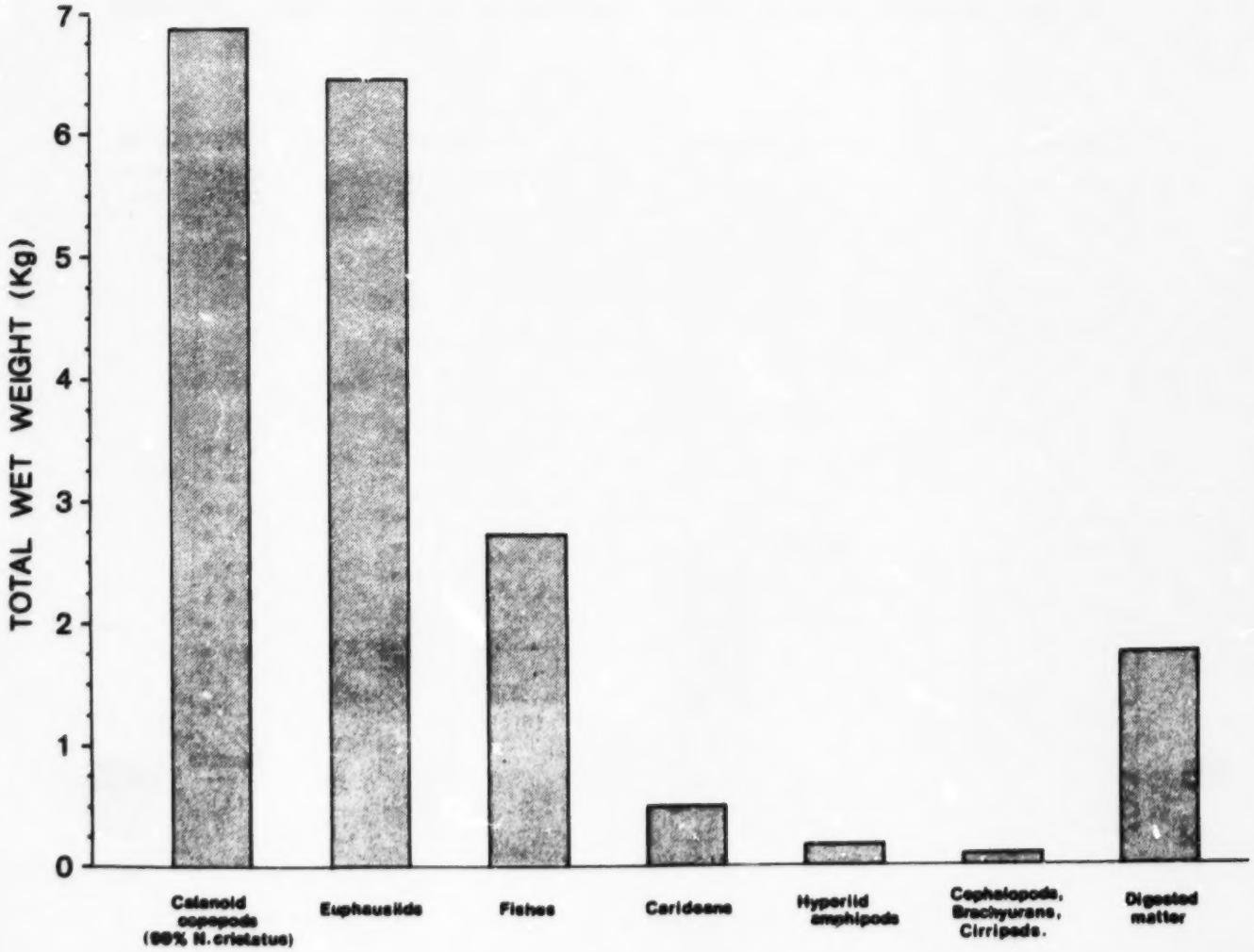

Figure 3. Overall composition of biomass (wet weight, 19 kg) of 998 meals of Cassin's Auklets, collected on Triangle, Frederick, Ramsay and Rankine islands from late May through July, 1978-1982.

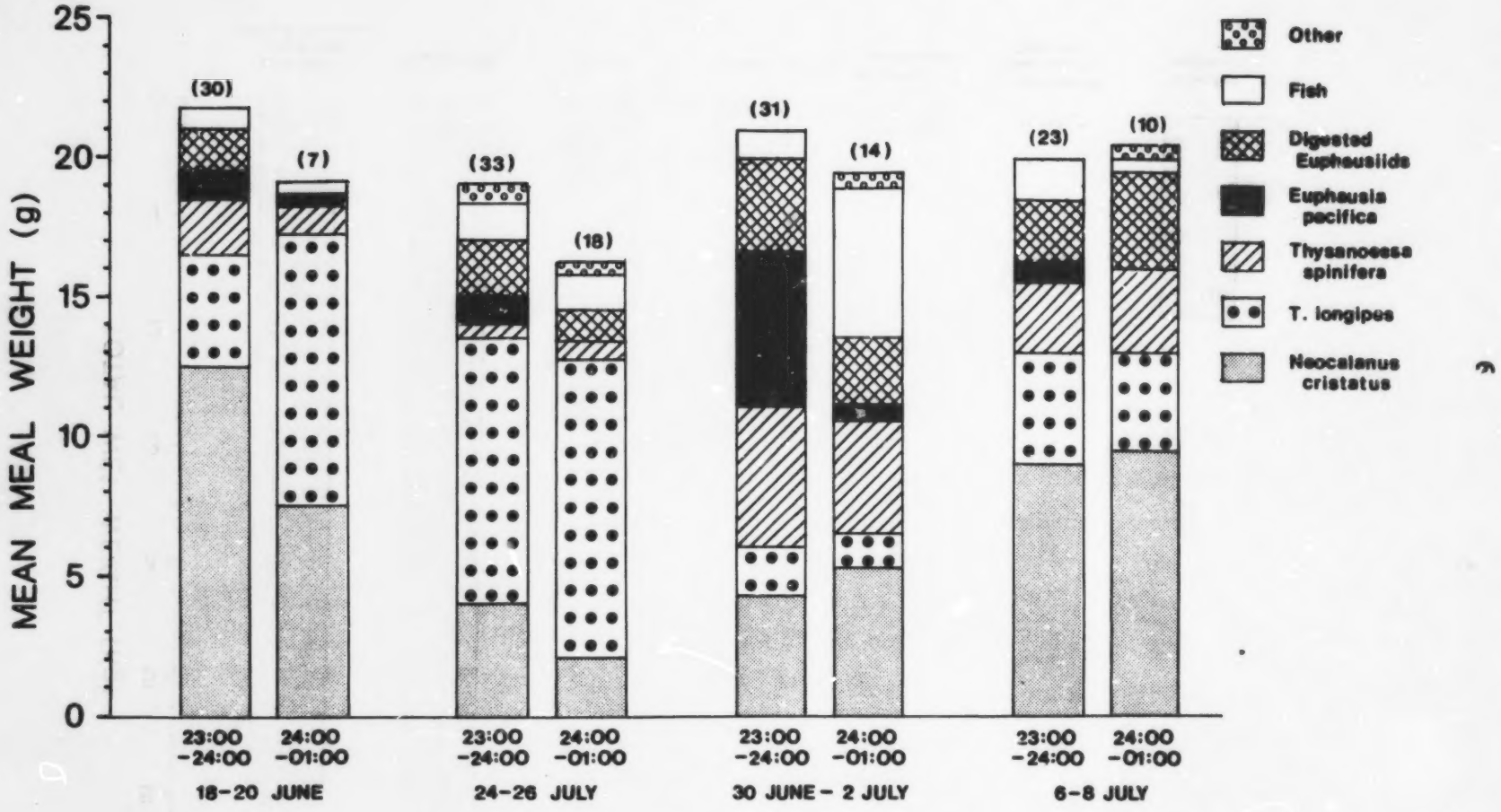

Figure 4. Comparison of average meal composition of nestling Cassin's Auklets between 23:00-24:00 h and 24:00-01:00 h on Triangle Island (number of meals in parentheses).

D. Changes in food composition

The mean composition of prey biomass in meals of nestling Cassin's Auklets at 4-day intervals on Triangle Island in 1982 is shown in Fig. 4. The same major prey categories occurred at all sampling periods (Fig. 4), but the composition of their occurrence changed significantly over the sampling period (Table 10). Similar seasonal changes in the diet of nestling Cassin's Auklets were previously observed by Vermeer (1981, 1985).

Neocalanus cristatus and Euphausia pacifica occurred significantly less in the second than in the first sampling hour at night, but the reverse held true for fishes (Table 11). Perhaps this reflects that auklets, which arrive at the colony after midnight, feed more on fishes which migrate to the sea surfce at dusk, than birds which arrive earlier.

ACKNOWLEDGEMENTS

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Table 1. Number of meals (n) and zooplankton biomass (g) collected from Cassin's Auklets on Triangle and Frederick islands from late May through July, 1978 to 1981, and from 1980 to 1981 respectively.

Collection period	Triangle Island								Frederick Island			
	1978		1979		1980		1981		1980		1981	
	n	g	n	g	n	g	n	g	n	g	n	g
27 May-3 June	28	526	39	869	44	671	34	624	32	495	6	95
12-17 July	-	-	-	-	-	-	-	-	42	662	18	281
25 June-4 July	42	757	46	1015	42	895	41	930	40	709	38	857
13-20 July	37	603	36	569	42	889	34	664	29	531	11	174
21-30 July	5	89	8	88	10	150	12	186	15	251	6	88
Total	112	1975	129	2541	138	2605	121	2404	158	2658	79	1495

Table 2. Number of meals (n) and zooplankton biomass (g) collected from Cassin's Auklets on Triangle, Ramsay and Rankine islands, May to July, 1982.

Collection periods	Triangle Island		Ramsay Island		Rankine Islands	
	n	g	n	g	n	g
30 May-3 June	-	-	27	455	23	470
18 June-20 June	37	783	-	-	-	-
24 June-26 June	51	960	-	-	-	-
30 June-2 July	45	1006	-	-	-	-
6 July-8 July	33	656	-	-	-	-
12 July-14 July	16	374	-	-	-	-
18 July-20 July	15	375	-	-	-	-
24 July-28 July	14	312	-	-	-	-
Total	211	4466	27	455	23	470

Table 3. Mean weights (in grams and SD) of meals carried by Cassin's Auklets to their nestlings on Triangle and Frederick islands, 1978 to 1981, and 1980 to 1981 respectively. Sample sizes are the same as in Table 1.

	Triangle Island				Frederick Island	
	1978	1979	1980	1981	1980	1981
27 May–3 June	18.8±10.2	22.3±7.9	15.3±7.2	18.4±9.3	15.5±7.8	15.8±9.0
12–17 June	-	-	-	-	15.8±7.9	15.6±8.6
25 June–4 July	18.0±6.9	22.1±7.8	21.3±8.8	22.7±8.7	17.7±8.6	22.6±8.3
13–20 July	16.3±7.3	15.8±7.3	21.2±8.0	19.5±8.6	18.3±8.3	15.8±6.3
21–30 July	17.8±6.6	11.0±8.5	15.0±9.3	15.5±9.4	17.4±9.0	14.7±6.6
Average meal size	17.6±8.0	19.7±8.5	18.9±8.5	19.7±9.3	16.8±8.3	18.9±8.4

Table 4. Mean weights (in grams and SD) of meals carried by Cassin's Auklets to their nestlings on Triangle, Ramsay and Rankine islands, 1982. Sample sizes are the same as in Table 2.

Collection periods	Triangle Island	Ramsay Island	Rankine Island
30 May–3 June	-	16.9±8.5	20.4±8.4
18 June–20 June	21.2±9.0		
24 June–26 June	18.8±9.5		
30 June–2 July	22.4±8.9		
6 July–8 July	19.9±9.4		
12 July–20 July	25.1±9.8		
24 July–28 July	22.3±7.9		
Average meal size	21.2±9.0	16.9±8.5	20.4±8.4

Table 5. Comparison of percentage occurrence of Cassin's Auklet prey, 1978-1982.

Major prey categories	Triangle Island					Frederick Island		Ramsay and Rankine islands
	1978	1979	1980	1981	1982	1980	1981	1982
Calanoid copepods (99% *Neocalanus cristatus*)	85.6	76.6	80.5	67.9	73.8	90.6	96.5	69.2
Euphausiids	73.2	57.4	83.9	80.9	93.5	65.6	94.2	100.0
Fishes	23.2	64.3	37.6	51.1	28.0	45.6	72.1	30.8
Carideans	22.3	25.6	23.5	9.9	13.6	58.3	31.4	42.3
Hyperiid amphipods	42.0	15.5	49.0	24.4	13.1	31.7	23.3	19.2
Cephalopods	-	-	0.7	7.6	0.9	0.6	10.5	-
Brachyurans (larvae)	-	-	16.1	9.9	8.4	2.8	5.8	7.7
Cirripeds (*Polymerus pollicipes*)	-	1.6	-	1.5	0.9	-	-	-
Scyphozoa (medusae)	-	-	-	1.5	1.4	-	2.3	1.9
Digested matter	89.3	70.5	72.5	-	2.3	5.6	-	7.8

Table 6. Comparison of average percentage wet weight of Cassin's Auklet prey, 1978-1982.

Major prey categories	Triangle Island						Frederick Island			Ramsay and Rankine islands
	1978	1979	1980	1981	1982	1978-82	1980	1981	1980-81	1982
Calanoid copepods (99% *Neocalanus cristatus*)	38.3	38.6	30.8	27.4	32.0	33.4	49.7	43.4	46.6	30.0
Euphausiids	24.8	15.0	25.3	39.6	58.4	32.6	15.4	31.8	23.6	51.4
Fishes	3.1	17.2	4.3	30.6	7.3	12.5	23.4	22.8	23.1	8.8
Carideans	3.3	5.0	0.7	0.1	1.4	2.1	7.7	0.7	4.2	1.0
Hyperiid amphipods	4.9	0.5	0.7	0.8	0.1	1.4	0.6	0.5	0.5	1.0
Cephalopods	-	-	0.01	1.2	0.01	0.3	0.8	0.4	0.6	-
Brachyurans (larvae)	-	-	0.2	0.3	0.1	0.1	0.01	0.3	0.2	1.5
Cirripeds (*Polymerus pollicipes*)	-	0.4	0.01	-	0.01	0.02	-	-	-	-
Scyphozoa (medusae)	-	-	-	0.02	0.02	0.01	-	0.05	0.03	trace
Digested matter	26.5	23.6	38.0	-	0.7	17.7	2.4	-	1.2	6.3

Table 7. Comparison of percentage occurrence of euphausiid prey of Cassin's Auklets, 1978-1982.

Prey species	Triangle Island					Frederick Island		Ramsay and Rankine Islands
	1978	1979	1980	1981	1982	1980	1981	1982
Thysanoessa spinifera (adults)	28.5	16.2	59.1	50.4	32.7	24.4	23.3	94.2
Thysanoessa spinifera (juveniles)*	-	-	4.7	15.3	25.2	10.0	7.0	28.8
Thysanoessa longipes (adults)	1.8	-	5.4	37.4	18.2	21.1	48.8	-
Thysanoessa longipes (juveniles)*	-	-	6.7	24.4	56.1	12.2	75.6	-
Thysanoessa raschii	0.9	3.9	-	-	-	-	-	-
Nematocelis difficilis	-	0.1	-	-	-	-	-	-
Unidentified Thysanoessa	10.7	8.5	-	-	-	-	-	-
Euphausia pacifica	13.4	1.6	21.5	23.7	18.7	18.3	5.8	9.6
Digested and unidentified euphausiids	68.8	38.0	40.9	13.0	15.4	30.0	4.7	3.8

* Not identified in 1978 and 1979.

Table 8. Comparison of percentage of wet weight of euphausiid prey of Cassin's Auklets, 1978-1982.

Major prey categories	Triangle Island					Frederick Island		Ramsay and Rankine Islands
	1978	1979	1980	1981	1982	1980	1981	1982
Thysanoessa spinifera (adults)	5.7	4.6	16.5	16.7	9.6	2.6	4.4	47.5
Thysanoessa spinifera (juveniles)	-	-	0.6	1.1	6.2	0.2	0.9	2.7
Thysanoessa longipes (adults)	0.5	-	0.5	5.8	4.3	1.6	4.2	-
Thysanoessa longipes (juveniles)	-	-	0.9	5.6	21.5	0.5	20.1	-
Thysanoessa raschii	0.1	0.2	-	-	-	-	-	-
Unidentified Thysanoessa	1.6	2.0	-	-	-	-	-	-
Euphausia pacifica	2.4	0.1	2.6	6.5	6.6	3.0	0.7	1.1
Digested and unidentified euphausiids	14.5	8.1	4.2	3.9	10.2	7.4	1.6	0.1

Table 9. Comparison of percentage occurrence of hyperiid amphipods and caridean prey of Cassin's Auklets, 1978-1982.

Major prey categories	Triangle Island					Frederick Island		Ramsay and Rankine islands
	1978	1979	1980	1981	1982	1980	1981	1982
Hyperiid amphipods								
Parathemisto pacifica (adults)	26.8	8.5	23.5	9.2	3.3	16.1	9.3	17.3
Parathemisto pacifica (juveniles)*	–	–	–	8.4	–	7.2	5.8	3.8
Vibilia propinqua	29.5	0.8	22.8	–	–	12.2	2.3	–
Primno macropa	–	–	4.7	9.2	8.9	12.2	11.6	5.8
Hyperia medusarum	2.7	2.3	1.3	–	1.9	2.8	–	1.9
Hyperoche medusarum	1.8	–	–	5.3	0.9	–	2.3	–
Phronima sedentaria	0.9	–	–	–	–	1.7	–	–
Paraphronima sp.	–	–	–	–	0.5	–	–	1.9
Calliopius sp.	–	1.6	–	–	–	–	–	–
Amphidipa sp.	–	1.6	–	–	–	–	–	–
Brachycelus sp.	–	–	6.7	–	–	2.2	–	–
Unid. and fragm. amphipods	7.1	7.8	8.1	–	–	–	–	–
Total hyperiid amphipods	42.0	15.5	49.0	24.4	13.1	31.7	23.3	19.2
Crideans								
Pandalopsis dispar	–	–	20.8	6.9	–	50.6	10.5	–
Pandalus platyceros	–	–	–	2.3	13.7	5.6	14.0	42.3
Eualus pacifica	22.3	25.6	0.7	–	–	0.6	–	–
Unid. and fragm. crideans				0.7	–	2.8	4.7	–
Total crideans	22.3	25.6	20.8	9.3	13.7	58.3	31.4	42.3

* Not identified in 1978 and 1979.

Table 10. Percentage occurrence of major prey items in meals of Cassin's Auklets during 3-day periods at 4-day intervals, Triangle Island, 1982. (Number of meals in parentheses.)

Major prey	Percentage occurrence			
	18-20 June (37)	24-26 June (51)	30 June -2 July (45)	6-8 July (33)
Neocalanus cristatus	86.5	66.7*	82.2	84.8
Thysanoessa spinifera	35.1	11.8*	48.9*	54.5
Thysanoessa longipes	67.6	70.6	42.2*	54.5
Euphausia pacifica	8.1	3.9	46.7*	9.1*
Fishes	18.9	15.7	35.6*	24.2

* Significantly different from preceding percentage occurrence ($p<0.05$).

Table 11. Percentage occurrence of major prey items in meals of Cassin's Auklets arriving at 23:00-24:00 h and at 24:00-1:00 h (Daylight Saving Time) at the Triangle Island colony, 18 June to 8 July 1982 (number of meals in parentheses).

Major prey	Percentage occurrence	
	23:00-24:00 h (117)	24:00-1:00h (49)
Neocalanus cristatus	81.2	73.5*
Thysanoessa spinifera	39.3	26.5
Thysanoessa longipes	59.0	59.2
Euphausia pacifica	22.2	6.1*
Fishes	20.5	30.6*

* Significantly different from preceding percentage occurrence ($p<0.05$).